



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 4, 2026 – 10:55 PM UTC

PDB ID : 5L3F / pdb_00005l3f
Title : LSD1-CoREST1 in complex with polymyxin B
Authors : Speranzini, V.; Rotili, D.; Ciossani, G.; Pilotto, S.; Forgione, M.; Lucidi, A.;
Forneris, F.; Velankar, S.; Mai, A.; Mattevi, A.
Deposited on : 2016-04-10
Resolution : 3.50 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

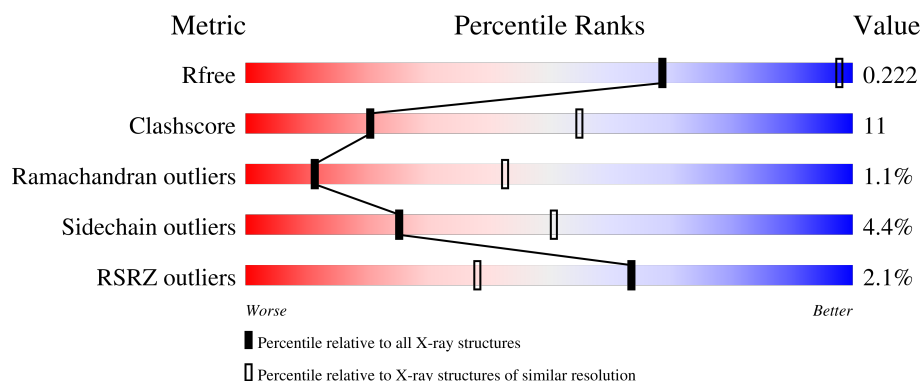
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

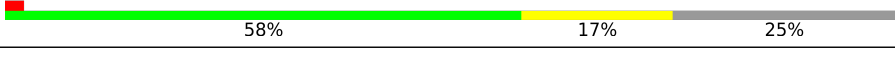
The reported resolution of this entry is 3.50 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1085 (3.54-3.46)
Clashscore	190562	1140 (3.54-3.46)
Ramachandran outliers	187476	1113 (3.54-3.46)
Sidechain outliers	187428	1114 (3.54-3.46)
RSRZ outliers	180081	1084 (3.54-3.46)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	730	 2% 63% 26% 9%
2	B	178	 2% 58% 17% 25%
3	C	11	 55% 27% 18%

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 6431 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Lysine-specific histone demethylase 1A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	666	Total	C	N	O	S	0	0	0
			5217	3324	906	967	20			

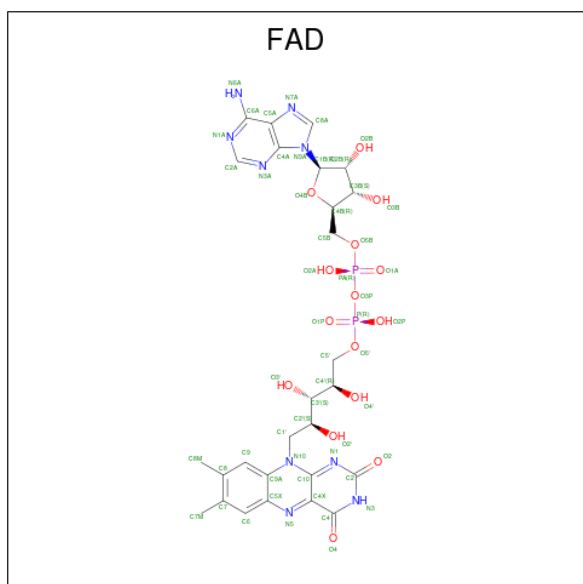
- Molecule 2 is a protein called REST corepressor 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	133	Total	C	N	O	S	0	0	0
			1076	676	194	203	3			

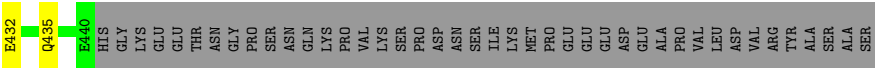
- Molecule 3 is a protein called Polmyxin B.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	11	Total	C	N	O	15	0	0
			85	56	16	13			

- Molecule 4 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		



● Molecule 3: Polmyxin B



4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	119.20Å 179.00Å 235.78Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.23 – 3.50 49.23 – 3.50	Depositor EDS
% Data completeness (in resolution range)	99.8 (49.23-3.50) 99.8 (49.23-3.50)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.48 (at 3.48Å)	Xtriage
Refinement program	PHENIX 1.8.4_1496	Depositor
R, R_{free}	0.186 , 0.210 0.202 , 0.222	Depositor DCC
R_{free} test set	637 reflections (1.24%)	wwPDB-VP
Wilson B-factor (Å ²)	109.9	Xtriage
Anisotropy	0.648	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 109.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.27$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	6431	wwPDB-VP
Average B, all atoms (Å ²)	123.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.51% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: DAB, 6FH, DTH, FAD, 4FO

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.86	0/5331	0.96	16/7232 (0.2%)
2	B	0.61	0/1091	0.79	0/1471
3	C	2.53	3/19 (15.8%)	0.86	0/24
All	All	0.83	3/6441 (0.0%)	0.93	16/8727 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	7	PHE	CA-C	-6.16	1.40	1.52
3	C	8	LEU	CA-C	-5.80	1.40	1.52
3	C	7	PHE	C-N	5.33	1.40	1.33

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	781	THR	CA-C-N	9.45	129.51	119.78
1	A	781	THR	C-N-CA	9.45	129.51	119.78
1	A	634	PRO	CA-C-N	6.57	126.92	119.83
1	A	634	PRO	C-N-CA	6.57	126.92	119.83
1	A	625	LEU	CA-C-N	6.05	127.41	119.84
1	A	625	LEU	C-N-CA	6.05	127.41	119.84
1	A	202	GLY	CA-C-N	5.67	125.58	119.85

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	202	GLY	C-N-CA	5.67	125.58	119.85
1	A	261	LEU	N-CA-C	-5.64	106.36	113.18
1	A	770	GLY	N-CA-C	-5.48	105.64	113.86
1	A	611	SER	N-CA-C	-5.28	107.21	113.97
1	A	469	LYS	CA-C-N	5.11	125.64	120.38
1	A	469	LYS	C-N-CA	5.11	125.64	120.38
1	A	811	VAL	N-CA-C	-5.11	107.42	111.81
1	A	370	VAL	CA-C-N	5.08	124.99	119.76
1	A	370	VAL	C-N-CA	5.08	124.99	119.76

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	792	PRO	Peptide

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	5217	0	5252	132	0
2	B	1076	0	1091	18	0
3	C	85	0	54	5	0
4	A	53	0	29	10	0
All	All	6431	0	6426	144	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 11.

All (144) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:331:ALA:HA	4:A:901:FAD:N5	2.01	0.76
1:A:280:LYS:N	1:A:619:ASP:OD2	2.20	0.70
1:A:667:ASP:HB3	1:A:744:LYS:HD2	1.76	0.68

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:335:THR:O	1:A:335:THR:OG1	2.13	0.65
1:A:537:GLU:HG3	1:A:544:LEU:HG	1.80	0.62
1:A:800:GLY:O	1:A:803:THR:OG1	2.16	0.61
1:A:384:ARG:NH1	2:B:312:LYS:O	2.33	0.60
1:A:321:ARG:HG2	1:A:326:VAL:HG22	1.84	0.60
1:A:693:LEU:HD12	1:A:694:PHE:H	1.66	0.59
1:A:647:LYS:O	1:A:651:VAL:HG23	2.02	0.59
1:A:663:VAL:HG22	1:A:704:LEU:HD11	1.85	0.58
1:A:188:MET:SD	1:A:200:ILE:HG23	2.43	0.58
1:A:287:GLY:HA3	4:A:901:FAD:O5B	2.04	0.57
1:A:334:VAL:O	1:A:336:GLY:N	2.32	0.57
1:A:448:MET:HE2	2:B:363:LEU:HD13	1.87	0.57
1:A:428:ILE:HG12	2:B:342:LEU:HD13	1.87	0.56
1:A:235:LEU:HD13	1:A:249:VAL:HG11	1.87	0.56
1:A:669:VAL:HG13	1:A:671:TRP:CE2	2.41	0.56
1:A:456:LYS:HG3	2:B:370:TYR:CZ	2.41	0.55
1:A:188:MET:HG2	1:A:210:PHE:HE1	1.70	0.54
1:A:221:TRP:CZ3	1:A:225:PRO:HA	2.42	0.54
1:A:266:ILE:HD11	1:A:578:LEU:HD23	1.90	0.54
1:A:559:GLU:HG2	3:C:9:DAB:HD1	1.72	0.53
1:A:197:PRO:HA	1:A:200:ILE:HD11	1.91	0.53
1:A:564:HIS:CD2	3:C:8:LEU:H	2.26	0.53
2:B:327:ASN:HB2	2:B:330:ALA:HB2	1.90	0.53
1:A:308:GLU:OE2	4:A:901:FAD:H1B	2.09	0.53
1:A:343:ALA:O	1:A:346:SER:OG	2.17	0.52
2:B:418:LYS:O	2:B:421:PHE:HB2	2.08	0.52
1:A:690:GLU:OE2	1:A:726:ARG:NH1	2.42	0.52
1:A:188:MET:HG2	1:A:210:PHE:CE1	2.45	0.52
1:A:384:ARG:HB3	2:B:314:MET:HE3	1.93	0.51
1:A:693:LEU:HD12	1:A:694:PHE:N	2.25	0.51
2:B:432:GLU:O	2:B:435:GLN:HG2	2.11	0.51
1:A:308:GLU:OE1	4:A:901:FAD:O3B	2.29	0.51
1:A:385:LEU:O	1:A:388:ALA:HB3	2.10	0.51
1:A:230:THR:HG23	1:A:270:ILE:HD12	1.93	0.50
1:A:366:ASN:OD1	1:A:367:GLY:N	2.45	0.50
1:A:773:TYR:HE2	1:A:808:PRO:HB3	1.76	0.50
1:A:371:PRO:HG2	1:A:374:LYS:HB2	1.93	0.50
1:A:521:LEU:HD22	1:A:525:ASP:HB3	1.93	0.49
1:A:379:GLU:O	1:A:382:PHE:HB3	2.12	0.49
3:C:5:4FO:O	3:C:7:PHE:N	2.45	0.48
1:A:384:ARG:HB3	2:B:314:MET:CE	2.43	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:439:GLU:HG3	2:B:352:ILE:HD13	1.95	0.48
1:A:720:ASP:O	1:A:724:VAL:HG23	2.13	0.48
1:A:308:GLU:OE2	4:A:901:FAD:O2B	2.24	0.48
1:A:773:TYR:CE2	1:A:808:PRO:HB3	2.48	0.48
1:A:644:PRO:O	1:A:648:THR:HG23	2.13	0.48
1:A:341:PRO:HG3	1:A:816:LEU:HD21	1.95	0.48
1:A:755:PRO:HA	1:A:758:ARG:NH1	2.28	0.48
1:A:552:TRP:CZ3	3:C:11:DTH:HG23	2.48	0.48
1:A:718:ILE:O	1:A:750:ARG:NH2	2.45	0.48
1:A:362:LEU:C	1:A:363:TYR:CD1	2.92	0.47
1:A:814:ALA:O	1:A:817:SER:N	2.46	0.47
1:A:647:LYS:HE2	1:A:647:LYS:HB2	1.51	0.47
1:A:331:ALA:HA	4:A:901:FAD:C4X	2.44	0.47
1:A:542:THR:HG21	1:A:763:TYR:CG	2.50	0.47
1:A:308:GLU:HB3	1:A:586:LEU:HD23	1.96	0.47
1:A:540:ASN:O	1:A:542:THR:HG22	2.15	0.47
1:A:770:GLY:O	1:A:773:TYR:N	2.45	0.47
1:A:209:VAL:O	1:A:213:ILE:HG13	2.15	0.47
1:A:282:ILE:HD13	1:A:282:ILE:HA	1.67	0.47
1:A:205:GLN:O	1:A:209:VAL:HG23	2.15	0.46
1:A:665:CYS:O	1:A:744:LYS:N	2.48	0.46
1:A:542:THR:OG1	1:A:546:THR:OG1	2.28	0.46
1:A:695:TRP:CE3	1:A:697:LEU:HD11	2.51	0.46
1:A:658:ASN:ND2	1:A:752:ARG:HB2	2.31	0.46
1:A:776:MET:HE2	1:A:802:HIS:HD2	1.80	0.46
1:A:474:ILE:HD12	1:A:474:ILE:HA	1.76	0.46
1:A:186:ASP:OD1	1:A:186:ASP:N	2.49	0.46
1:A:380:GLN:HG2	1:A:384:ARG:HD3	1.98	0.46
2:B:383:TRP:CD2	2:B:412:LYS:HE2	2.51	0.46
1:A:812:HIS:O	1:A:816:LEU:HG	2.16	0.45
1:A:808:PRO:O	1:A:810:THR:HG23	2.17	0.45
1:A:455:ILE:HG23	1:A:487:LEU:HD11	1.99	0.45
1:A:296:GLN:O	1:A:299:SER:HB3	2.17	0.44
1:A:360:CYS:HA	1:A:361:PRO:HD2	1.88	0.44
1:A:743:PRO:HB2	1:A:746:THR:HG23	1.99	0.44
1:A:537:GLU:CG	1:A:544:LEU:HG	2.46	0.44
1:A:626:PRO:HD3	4:A:901:FAD:H52A	1.99	0.44
1:A:386:LEU:HD23	1:A:386:LEU:HA	1.72	0.44
1:A:547:LEU:HD23	1:A:547:LEU:HA	1.83	0.44
1:A:648:THR:O	1:A:651:VAL:N	2.50	0.44
1:A:267:TYR:N	1:A:267:TYR:CD1	2.86	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:474:ILE:HD12	1:A:477:GLU:HB3	1.98	0.44
1:A:451:LEU:HD12	1:A:451:LEU:HA	1.71	0.43
1:A:524:ARG:O	1:A:528:ILE:HG13	2.18	0.43
1:A:283:ILE:HG12	1:A:622:LEU:HB3	2.00	0.43
1:A:315:GLY:C	1:A:317:VAL:H	2.26	0.43
1:A:458:LEU:HA	1:A:458:LEU:HD23	1.74	0.43
1:A:760:SER:CA	4:A:901:FAD:HM82	2.48	0.43
4:A:901:FAD:H8A	4:A:901:FAD:H2B	1.86	0.43
1:A:458:LEU:HB3	1:A:487:LEU:HD13	2.00	0.43
1:A:479:LEU:HD11	1:A:483:LYS:HE2	2.00	0.43
1:A:704:LEU:HA	1:A:704:LEU:HD12	1.72	0.43
1:A:760:SER:HA	4:A:901:FAD:HM82	2.01	0.43
1:A:235:LEU:HD21	1:A:246:THR:HG22	2.00	0.43
2:B:397:LYS:HD3	2:B:398:TYR:CE2	2.53	0.43
1:A:332:MET:HE2	1:A:661:LYS:NZ	2.34	0.43
1:A:572:SER:O	1:A:575:PRO:HD2	2.18	0.43
1:A:555:ASP:OD1	1:A:555:ASP:N	2.43	0.43
1:A:564:HIS:HD2	3:C:8:LEU:HB2	1.82	0.43
2:B:384:THR:OG1	2:B:386:GLU:HB3	2.19	0.43
1:A:600:CYS:SG	1:A:795:ARG:HB3	2.58	0.43
1:A:296:GLN:HG3	1:A:819:LEU:HD22	2.01	0.43
1:A:447:LYS:HD2	1:A:497:LEU:HD21	2.01	0.43
1:A:594:ARG:HA	1:A:640:VAL:O	2.19	0.43
1:A:780:ILE:HB	1:A:796:LEU:HB3	2.01	0.43
1:A:200:ILE:H	1:A:200:ILE:HG13	1.31	0.43
1:A:305:THR:OG1	1:A:583:ASP:OD2	2.31	0.42
1:A:592:GLN:HB3	1:A:603:ILE:HD12	2.00	0.42
1:A:315:GLY:O	1:A:317:VAL:N	2.52	0.42
1:A:391:TYR:CD1	1:A:395:GLN:HG3	2.54	0.42
1:A:386:LEU:O	1:A:389:THR:OG1	2.23	0.42
1:A:806:ASN:C	1:A:807:TYR:CD1	2.97	0.42
2:B:414:VAL:O	2:B:417:VAL:HB	2.19	0.42
1:A:325:TYR:CE2	1:A:665:CYS:HB3	2.55	0.42
2:B:310:PRO:HB3	2:B:316:LEU:HD12	2.02	0.42
1:A:255:TYR:CD2	1:A:256:LEU:HD23	2.55	0.42
1:A:731:LEU:HD23	1:A:731:LEU:HA	1.85	0.42
1:A:487:LEU:HD12	1:A:487:LEU:HA	1.79	0.41
1:A:707:VAL:HG12	1:A:712:ALA:HA	2.02	0.41
1:A:694:PHE:HA	1:A:704:LEU:O	2.20	0.41
1:A:786:ILE:H	1:A:786:ILE:HD12	1.85	0.41
1:A:676:ASN:HD22	1:A:676:ASN:HA	1.71	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:361:PRO:HB2	1:A:363:TYR:CE1	2.56	0.41
1:A:797:PHE:CE1	1:A:825:ILE:HG12	2.56	0.41
1:A:229:LEU:N	1:A:263:ASN:OD1	2.34	0.41
1:A:340:ASN:HA	1:A:341:PRO:HD2	1.87	0.41
1:A:385:LEU:HD23	1:A:415:VAL:CG1	2.51	0.41
1:A:392:LEU:O	1:A:396:LEU:HB2	2.20	0.41
1:A:441:LEU:HD23	2:B:356:ASN:HD22	1.85	0.41
1:A:763:TYR:HE1	1:A:765:ALA:HA	1.86	0.41
2:B:314:MET:HE2	2:B:314:MET:HB2	1.94	0.41
1:A:775:LEU:HD23	1:A:775:LEU:HA	1.85	0.40
1:A:572:SER:C	1:A:575:PRO:HD2	2.46	0.40
1:A:654:MET:HE2	1:A:654:MET:HB3	1.93	0.40
1:A:217:THR:O	1:A:218:LEU:C	2.62	0.40
1:A:601:GLU:OE1	1:A:617:LYS:HE3	2.22	0.40
1:A:779:PRO:HB3	1:A:797:PHE:CD2	2.57	0.40
2:B:384:THR:HG23	2:B:387:GLU:OE1	2.21	0.40
1:A:297:LEU:HA	1:A:297:LEU:HD23	1.76	0.40
1:A:793:ILE:HA	1:A:794:PRO:HD3	1.86	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	664/730 (91%)	604 (91%)	53 (8%)	7 (1%)	11	43
2	B	131/178 (74%)	126 (96%)	3 (2%)	2 (2%)	8	37
3	C	2/11 (18%)	1 (50%)	1 (50%)	0	100	100
All	All	797/919 (87%)	731 (92%)	57 (7%)	9 (1%)	11	43

All (9) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	316	ARG
1	A	402	ASN
1	A	401	LEU
1	A	809	ALA
1	A	785	SER
2	B	331	ALA
2	B	401	ASP
1	A	793	ILE
1	A	313	VAL

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	566/623 (91%)	540 (95%)	26 (5%)	24	50
2	B	117/156 (75%)	113 (97%)	4 (3%)	32	57
3	C	2/2 (100%)	2 (100%)	0	100	100
All	All	685/781 (88%)	655 (96%)	30 (4%)	25	51

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	200	ILE
1	A	239	GLU
1	A	247	VAL
1	A	267	TYR
1	A	282	ILE
1	A	304	VAL
1	A	313	VAL
1	A	328	ASP
1	A	335	THR
1	A	392	LEU
1	A	400	VAL
1	A	429	GLU
1	A	434	ILE
1	A	447	LYS

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Mol	Chain	Res	Type
1	A	449	VAL
1	A	482	SER
1	A	561	THR
1	A	588	THR
1	A	598	SER
1	A	626	PRO
1	A	647	LYS
1	A	659	LEU
1	A	677	LEU
1	A	699	LYS
1	A	717	ASN
1	A	811	VAL
2	B	344	SER
2	B	376	ILE
2	B	415	VAL
2	B	426	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	185	HIS
1	A	298	GLN
1	A	399	ASN
1	A	419	GLN
1	A	532	HIS
1	A	564	HIS
1	A	632	GLN
1	A	742	GLN
1	A	812	HIS
1	A	828	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

8 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and

the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
3	DAB	C	9	3	5,6,7	0.48	0	1,6,8	0.12	0
3	4FO	C	4	3	5,6,7	0.49	0	1,6,8	0.10	0
3	DAB	C	10	3	5,6,7	0.64	0	1,6,8	0.20	0
3	DAB	C	6	3	5,6,7	0.57	0	1,6,8	0.36	0
3	4FO	C	5	3	5,6,7	0.54	0	1,6,8	0.16	0
3	4FO	C	2	3	5,6,7	0.60	0	1,6,8	0.20	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	DAB	C	9	3	-	0/4/5/7	-
3	4FO	C	4	3	-	0/4/5/7	-
3	DAB	C	10	3	-	2/4/5/7	-
3	DAB	C	6	3	-	3/4/5/7	-
3	4FO	C	5	3	-	1/4/5/7	-
3	4FO	C	2	3	-	0/4/5/7	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	C	5	4FO	CA-CB-CG-NZ
3	C	6	DAB	C-CA-CB-CG
3	C	6	DAB	CA-CB-CG-ND
3	C	10	DAB	CA-CB-CG-ND
3	C	10	DAB	N-CA-CB-CG
3	C	6	DAB	N-CA-CB-CG

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	9	DAB	1	0
3	C	5	4FO	1	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

1 ligand is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
4	FAD	A	901	-	58,58,58	2.56	17 (29%)	85,89,89	2.08	23 (27%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	FAD	A	901	-	-	5/34/50/50	0/6/6/6

All (17) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	901	FAD	C2B-C1B	-7.89	1.28	1.53
4	A	901	FAD	O4B-C1B	7.44	1.59	1.42
4	A	901	FAD	O4B-C4B	-6.18	1.31	1.45
4	A	901	FAD	C10-N1	5.62	1.44	1.33
4	A	901	FAD	C2-N1	5.01	1.48	1.36
4	A	901	FAD	C6A-N6A	4.37	1.45	1.34
4	A	901	FAD	O2'-C2'	-4.21	1.34	1.43
4	A	901	FAD	C4X-N5	3.90	1.39	1.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	901	FAD	O3B-C3B	-3.31	1.34	1.43
4	A	901	FAD	C2-N3	3.22	1.46	1.39
4	A	901	FAD	C9A-N10	3.19	1.46	1.41
4	A	901	FAD	C5X-N5	3.17	1.45	1.39
4	A	901	FAD	C8A-N7A	2.87	1.37	1.31
4	A	901	FAD	C10-N10	2.78	1.43	1.37
4	A	901	FAD	C4A-N3A	2.28	1.38	1.34
4	A	901	FAD	C5A-C4A	-2.28	1.35	1.39
4	A	901	FAD	C5A-C6A	-2.13	1.35	1.41

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	901	FAD	N3A-C2A-N1A	-6.19	119.20	128.58
4	A	901	FAD	N6A-C6A-N1A	-4.91	107.44	118.38
4	A	901	FAD	C7M-C7-C6	-4.80	111.12	119.57
4	A	901	FAD	C5A-C4A-N3A	-4.72	120.22	126.72
4	A	901	FAD	C5'-C4'-C3'	-4.68	103.38	112.22
4	A	901	FAD	C7M-C7-C8	4.15	129.23	120.76
4	A	901	FAD	N9A-C8A-N7A	-4.10	108.12	113.94
4	A	901	FAD	C5A-C6A-N6A	3.92	133.00	123.29
4	A	901	FAD	N3A-C4A-N9A	3.80	133.63	127.17
4	A	901	FAD	C4-N3-C2	-3.67	119.13	125.64
4	A	901	FAD	C4-C4X-C10	3.32	122.63	116.93
4	A	901	FAD	C2A-N3A-C4A	3.12	119.46	111.83
4	A	901	FAD	O4-C4-C4X	-3.02	118.56	126.53
4	A	901	FAD	C4X-C10-N1	-2.92	117.44	124.59
4	A	901	FAD	C4A-N9A-C8A	2.86	108.75	105.74
4	A	901	FAD	C6A-C5A-C4A	2.57	120.69	117.18
4	A	901	FAD	C5X-C9A-N10	2.54	120.27	117.97
4	A	901	FAD	O4'-C4'-C3'	2.48	115.04	109.25
4	A	901	FAD	C4X-C4-N3	2.46	119.52	113.25
4	A	901	FAD	C6-C5X-C9A	2.37	122.30	119.05
4	A	901	FAD	C5A-N7A-C8A	2.28	107.03	103.45
4	A	901	FAD	C8M-C8-C7	-2.26	116.15	120.76
4	A	901	FAD	O2'-C2'-C3'	-2.08	104.38	109.25

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	901	FAD	O4'-C4'-C5'-O5'

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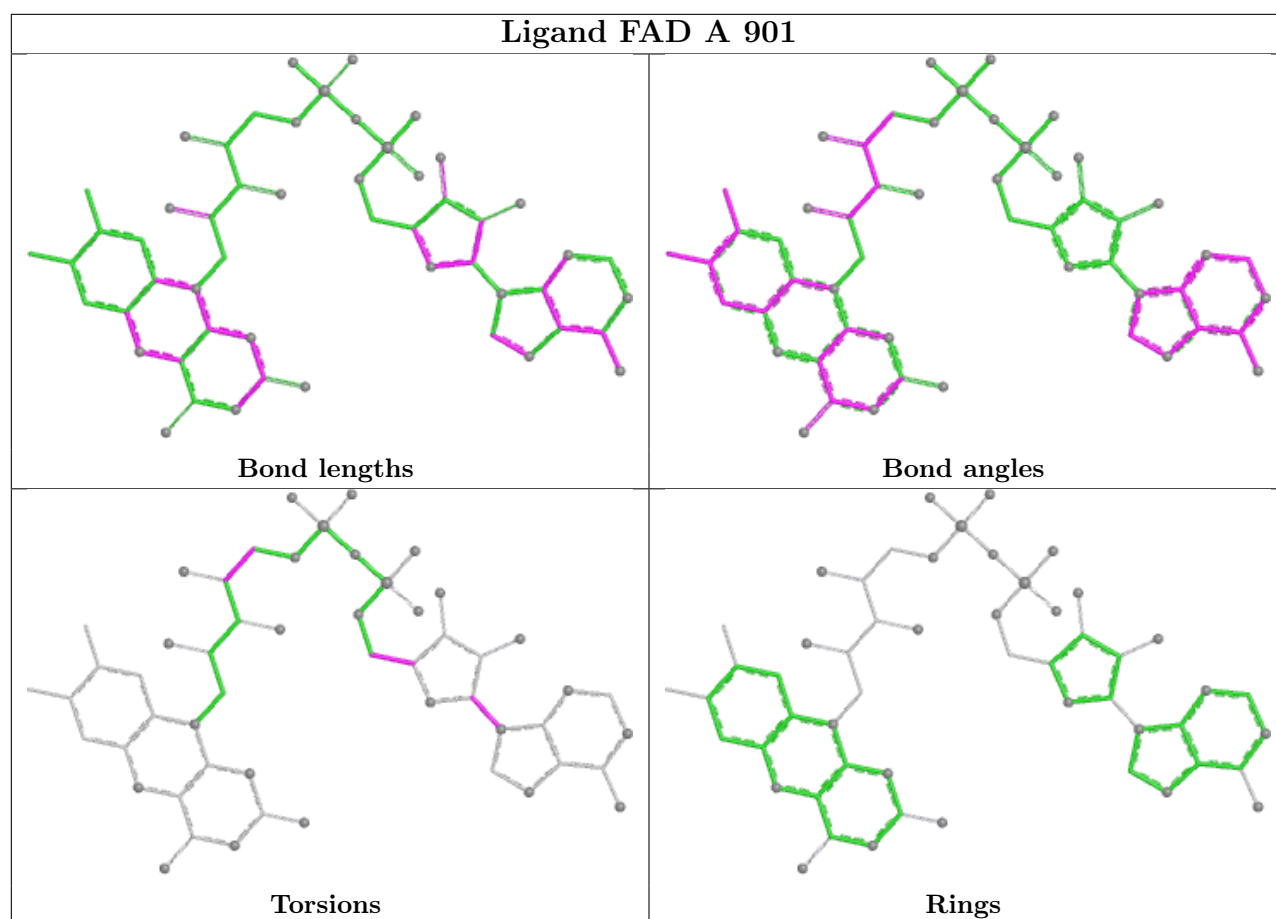
Mol	Chain	Res	Type	Atoms
4	A	901	FAD	C3'-C4'-C5'-O5'
4	A	901	FAD	C3B-C4B-C5B-O5B
4	A	901	FAD	O4B-C4B-C5B-O5B
4	A	901	FAD	C2B-C1B-N9A-C8A

There are no ring outliers.

1 monomer is involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	901	FAD	10	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	666/730 (91%)	-0.09	13 (1%) 65 39	76, 110, 162, 239	0
2	B	133/178 (74%)	0.23	4 (3%) 52 30	113, 153, 208, 294	0
3	C	2/11 (18%)	1.67	0 100 100	176, 176, 176, 182	0
All	All	801/919 (87%)	-0.03	17 (2%) 63 38	76, 117, 178, 294	0

All (17) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	352	GLU	3.2
1	A	350	ASN	3.0
1	A	568	ARG	3.0
1	A	569	ASN	2.9
1	A	354	ALA	2.8
2	B	323	ALA	2.8
1	A	353	LEU	2.7
1	A	171	PRO	2.5
2	B	332	THR	2.4
1	A	247	VAL	2.3
1	A	835	THR	2.2
2	B	328	ALA	2.1
1	A	836	LEU	2.1
1	A	205	GLN	2.1
2	B	324	VAL	2.0
1	A	401	LEU	2.0
1	A	467	GLU	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum,

median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	4FO	C	2	7/8	0.57	0.27	186,187,189,189	5
3	4FO	C	5	7/8	0.66	0.18	190,193,198,199	0
3	DAB	C	6	7/8	0.79	0.21	187,188,190,196	0
3	DTH	C	3	7/8	0.85	0.15	188,192,195,198	0
3	DAB	C	9	7/8	0.87	0.28	183,185,190,191	0
3	4FO	C	4	7/8	0.90	0.20	189,194,197,197	0
3	DAB	C	10	7/8	0.90	0.30	177,185,193,197	0
3	DTH	C	11	7/8	0.96	0.18	195,196,197,198	0

6.3 Carbohydrates [i](#)

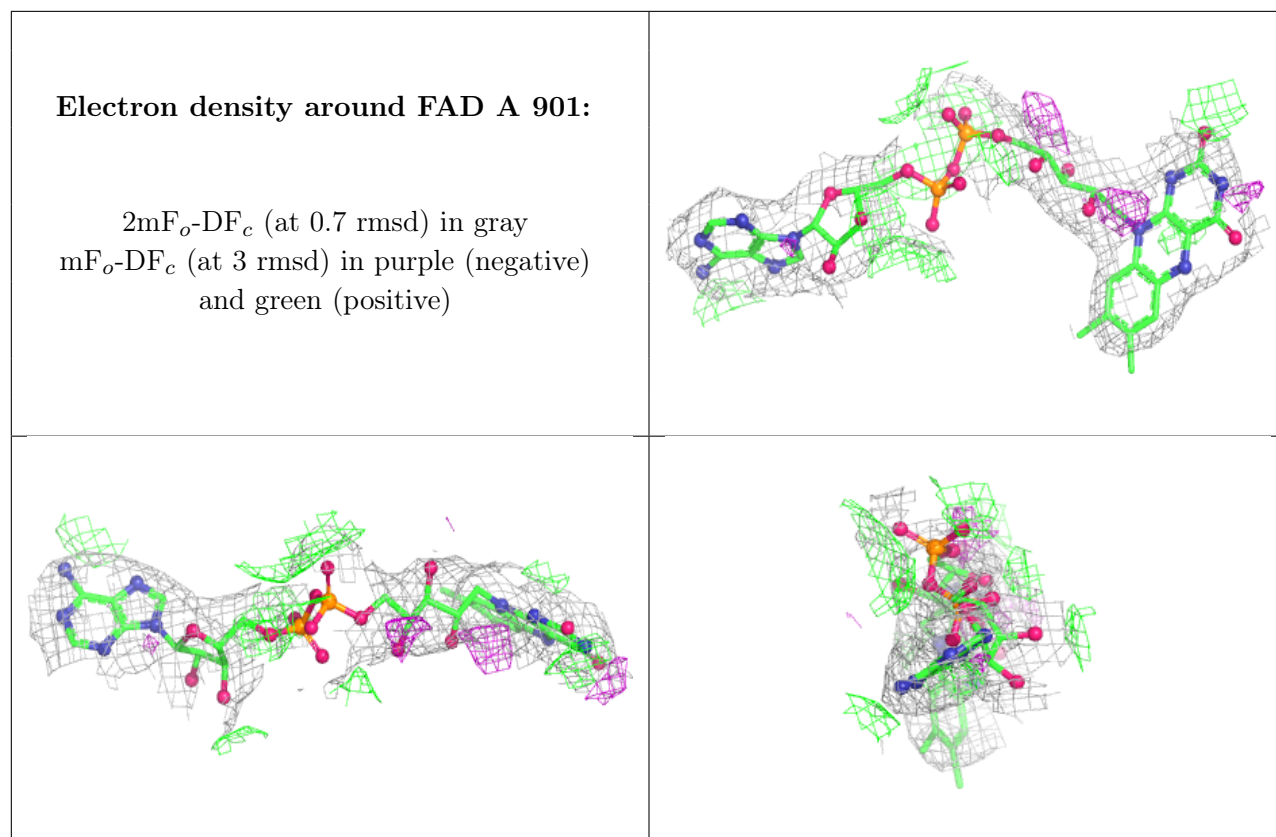
There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	FAD	A	901	53/53	0.96	0.08	60,86,99,109	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



6.5 Other polymers [i](#)

There are no such residues in this entry.